

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

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A control system for controlling automated applications in a building environment comprising:

a communications network;

a plurality of application controllers connected to said communications network, each of said application controllers including means for controlling operation of a corresponding automated device, each of said application controllers including a controller type;

a control interface connected to said communications network, said control interface including a database of at least one profile for an application controller type; and

self-configuration means for providing automated configuration of each of said application controllers on said network, said self-configuration means including means for conveying said controller type of said application controller from said application controller to said control interface, said self-configuration means further including means for configuring said application controller based on said profile corresponding to said controller type of said application controller.

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The control system of claim 1 wherein each of said application controllers controls operation of said corresponding automated device in accordance with at least one variable; and

wherein said control interface includes means for controlling operation of said application controller by specifying a value of said variable.

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The control system of claim 2 wherein said database of at least one profile for a controller type is further defined as including a plurality of profiles for application controllers of different controller types.

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The control system of claim 3 wherein said control interface includes means for transmitting explicit messages to said application controllers, each of said explicit messages including an identification unique to a specific one of said application controllers; and

said application controllers each including means for receiving said explicit messages from said control interface, said means for receiving including means for recognizing only those of said explicit messages which include an identification unique to said application controller in which said means for receiving resides.

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The control system of claim 4 wherein said means for transmitting explicit messages include means for incorporating said value of said variable into said explicit message.

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The control system of claim 5 wherein said database of profiles includes input, output and configuration data structures for said application controllers.

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The control system of claim 6 wherein each of said application controllers include an occupancy status;

said control interface including means for grouping a plurality of application controllers into an occupancy group; and

means for defining said occupancy status of each of said application controllers in a given occupancy group as a group.

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The control system of claim 7 further comprising a network server interface, said network server interface including means for monitoring and controlling operation of said control system over an Internet connection.

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The control system of claim 4 wherein said control interface includes means for monitoring a status of each of said application controllers, said means for monitoring including a means for periodically transmitting a ping to each of said application controllers and a means for receiving a response to said ping from each of said application controllers.

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The control system of claim 9 wherein each of said application controllers includes a means for receiving said ping from said control interface and a means for transmitting a response to said ping to said control interface.

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The control system of claim 4 wherein said plurality of application controllers includes at least one HVAC application controller, at least one lighting application controller and at least one access control application.

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The control system of claim 4 wherein said local control interface further includes:

a database of application controller control software images; and

means for downloading said control software images into at least one of said application controllers.

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The control system of claim 12 further comprising means for downloading said application controller control software images into said local control interface from an external source, whereby said application controller control software images can be upgraded.

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The control system of claim 13 wherein at least one of said application controllers is preprogrammed with basic networking and configuration software enabling said at least one application controller to receive and install said application controller control software images downloaded by said local control interface.

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The control system of claim 4 wherein said local control interface further includes means for downloading a local control interface control software image into said local control interface.

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The control system of claim 15 further comprising means for downloading said local control interface control software image into said local control interface from an external source, whereby said local control interface control software images can be upgraded.

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The control system of claim 16 wherein at least one of said local control interface is preprogrammed with basic networking and configuration software enabling said local control interface to receive and install said local control interface control software image downloaded by said local control interface.

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The control system of claim 4 wherein at least one of said local control interface and said application controllers is preprogrammed with a generic programming language and includes means for downloading a control program to be run by said programming language to define operation of at least one of said local control interface and said application controllers.

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A control system for automated applications in a building environment comprising:

a communications network;

a plurality of application controllers connected to said network, each of said application controllers providing automated operation of a corresponding application, each of said application controllers being capable of providing automated operation of said corresponding application in accordance with a plurality of control variables; and

a control interface connected to said network, said control interface including means for transmitting explicit messages to each of said application controllers, said explicit messages including commands for adjusting said control variables of said application controller;

wherein each of said application controllers includes means for processing said commands received from said control interface in said explicit messages and means for adjusting

a value of said control variables in accordance with said command, whereby said control interface is capable of controlling operation of said application controllers.

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The system of claim 19 wherein said application controllers include application controllers of a plurality of different controller types;

said control interface including a preprogrammed database containing at least one profile, said profile defining said control variables for said one of said controller types.

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The system of claim 20 wherein said preprogrammed database containing a plurality of profiles, each of said profiles being uniquely associated with one of said controller types and defining said control variables for said one of said controller types.

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The system of claim 20 wherein said controller types include at least an HVAC controller type, a lighting controller type and an access controller type.

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The system of claim 22 further comprising a network server interface, said network server interface including means for monitoring and controlling operation of said control system over an Internet connection.

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The system of claim 23 wherein said control interface includes a means for periodically transmitting a ping to each of said application controllers and a means for receiving a response to said ping from each of said application controllers.

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The system of claim 24 wherein each of said application controllers includes a means for receiving said ping from said control interface and a means for transmitting a response to said ping to said control interface.

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The system of claim 25 wherein said ping for at least one of said application controllers includes data for updating said application controller with current system information, said application controller including means for updating certain of said control variables in accordance with said current system information.

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The system of claim 26 wherein said response transmitted by at least one of said application controllers includes data relevant to at least one other of said application controllers, said control interface including means for transmitting said data included in said response to said other of said application controllers.

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The system of claim 27 wherein said control interface includes means for generating an alarm if any of said application controllers fails to respond to said ping.

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The system of claim 28 further comprising self-configuration means for providing automated configuration of each of said application controllers on said network, said self-configuration means including means for conveying said controller type of said application controller from said application controller to said control interface, said self-configuration means

further including means for configuring said application controller based on said profile corresponding to said controller type of said application controller.

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The system of claim 29 wherein each of said application controllers includes an occupancy status;

said interface controller including a means for grouping said application controllers into occupancy groups; and

said interface controller further including means for defining as a group said occupancy status of each of said application controller is a given group.

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The system of claim 30 wherein said control interface includes:

means for calculating a person count for at least one of said groups based on access entry and access exit information received by said control interface from an access control unit;

means for defining said occupancy status of said controllers within said group based on said person count.

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A control system for controlling operation of automated applications within a building environment comprising:

a communications network;

a plurality of application controllers connected to said network, each of said application controllers having a controller type and including means for controlling operation of

a corresponding application in accordance with a plurality of control variables, each of said application controllers including means for exchanging explicit messages over said network;

a control interface connected to said network, said control interface including means for exchanging explicit messages with said application controllers, said control interface including a profile database containing at least one profile, said profile providing an identification of and data structure for said control variables for said controller type; and

configuration means for configuring said application controllers within said control interface, said configuration means including means for exchanging explicit messages with an application controller to obtain said controller type of said application controller and means for accessing said profile database to determine said control variables relevant to operation of said application controller and said data structure of said control variables.

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The control system of claim 32 wherein said profile database includes a plurality of profiles, each profile uniquely associated with one of said controller types and providing an identification of and data structure for each of said control variables for said controller type.

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The system of claim 33 wherein said means for exchanging explicit messages of said application controllers and said means for exchanging explicit messages of said control interface each includes means for transmitting messages using explicit addressing and means for receiving messages using explicit addressing.

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The system of claim 34 wherein each of said application controllers includes an occupancy status; and

wherein said control interface includes means for grouping said application controllers into occupancy groups and means for controlling said occupancy status of said application controllers as a occupancy group.

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The system of claim 35 wherein said means for controlling occupancy status of said application controllers as a occupancy group includes:

means for storing a list of application controllers by occupancy group;

means for changing said occupancy status of at least one of said groups by transmitting explicit messages to each of said application controllers contained in said list of application controllers for said group, whereby said control interface provides a level of integration between application controllers that is transparent to said application controllers.

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The system of claim 36 wherein said control interface includes means for periodically sending a ping message to at least one of said application controllers, said ping message being an explicit message sent by explicit addressing and including a value of at least one control variable for said application controller; and

said application controller including means for updating within said application controller a value of said control variable sent to said application controller in said ping message, whereby said control interface may affect operation of said application controller.

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The system of claim 37 wherein at least one of said application controllers includes means for sending a response message to said control interface in response to each of said ping messages received from said control interface.

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The system of claim 38 wherein said application controllers includes an access application controller for an access control unit, said access application controller including means for transmitting an access request message to said control interface and means for granting and denying access based on an access response message received from said control interface; and

said control interface including means for processing said access request message and means for transmitting said access response message to said access application controller.

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The system of claim 39 wherein said control interface include means for maintaining a person count as a function of access events.

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The system of claim 40 wherein said control interface include means for controlling an occupancy status of an occupancy group as a function of said person count.

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The system of claim 41 further comprising a network server interface, said network server interface including means for monitoring and controlling operation of said control system over an Internet connection.

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A method for configuring a control system for automated applications in a building environment, comprising the steps of:

providing a control interface and an application controller connected to a communications network;

pre-storing in the control interface a profile database containing at least one profile for at least one controller type, said profile including information required for configuration of an application controller of corresponding controller type;

pre-storing in the application controller a controller type;

providing the controller type to the control interface;

retrieving the profile from the database of profiles corresponding to the controller type provided to the control interface; and

configuring the application controller in accordance with the retrieved profile.

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The method of claim 43 wherein the profile database includes a plurality of profiles, each uniquely associated with a different controller type.

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The method of claim 43 further comprising the step of transmitting an initiating message from the application controller to the control interface to initiate communications.

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The method of claim 45 wherein said step of transmitting an initiating message includes the steps of:

activating a service pin on the application controller; and

transmitting a message from the application controller to the control interface including a controller identification unique to the application controller.

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The method of claim 46 further comprising the steps of:

storing the controller identification in a table in the control interface;

assigning a device identification to the application controller;
sending a message from the control interface to the application controller
including the device identification; and
storing the device identification in the application controller, whereby the
application controller can retrieve the device identification for later use in sending messages to
the control interface.

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The method of claim 47 further comprising the steps of:

sending a message from the control interface to the application controller
including a controller identification unique to the control interface;
storing the control interface controller identification in the application controller,
whereby the application controller can retrieve the control interface controller identification for
later use in sending messages to the control interface.

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A method for controlling operation of automated applications within a building
environment, comprising the steps of:

providing a communication network;
providing an application controller for each application to be controlled, each
application controller controlling operation of the corresponding application in accordance with a
plurality of control variables, each application controller having a controller type and being
connected to the network;

providing a control interface connected to the network, the control interface being preprogrammed with at least one profile of control variables supported by at least one of said controller types; and

configuring an application controller of said at least one controller type within the control interface by retrieving the corresponding preprogrammed profile.

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The method of claim 49 wherein the control interface is preprogrammed with a plurality of profiles, each profile being uniquely associated with a different controller type, each profile defining the control variables supported by the associated controller type.

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The method of claim 50 wherein each of the profiles includes a data structure for each of the control variables supported by the corresponding controller type.

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The method of claim 51 further comprising the step of controlling operation of an application controllers via the control interface, including the steps of:

transmitting an explicit messages from the control interface to an application controllers, the explicit message including a value of at least one of the control variable for the application controller in a format corresponding with the data structure for the control variable defined in the profile corresponding to the controller type of the application controller; and

modifying a value of the control variable within the application controller to affect operation of the application controller.

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The method of claim 52 further comprising the steps of:

periodically transmitting a ping message from the control interface to each of the application controllers, the ping message including a value of at least one control variables for the application controller;

updating the value of the control variable in the application controller in accordance with the value contained in the ping message; and

transmitting a response message from the application controller to the control interface.

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The method of claim 53 wherein the response message includes a value of at least one control variable for the application controller.

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The method of claim 54 further comprising the steps of:

preprogramming the application controllers to recognize the data structure for the explicit messages supported by that application controller;

preprogramming the control interface to recognize the data structure for the explicit messages supported by the control system.

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The method of claim 55 wherein each of the application controllers includes an occupancy status; and

further comprising the steps of:

grouping a plurality of application controllers into an occupancy group; and

controlling the occupancy status of the application controllers by occupancy group.

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The method of claim 56 wherein said step of controlling the occupancy status of the application controllers by occupancy group includes the steps of:

maintaining in the control interface a database containing the application controllers by occupancy group; and

transmitting individual explicit messages from the control interface to each of the application controllers in a specific group, whereby occupancy group control is resident only on the control interface and is transparent to the application controllers.

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The method of claim 57 wherein the controller types include at least a lighting controller type, an HVAC controller type and an access controller type.

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The method of claim 58 further comprising the step of modifying the occupancy status of a group by in response to a access events reported to the control interface by application controllers of the access controller type.

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The method of claim 59 wherein at least one occupancy group includes applications controllers of different controller types, whereby said step of controlling occupancy status by occupancy group results in integration across controller type.

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The method of claim 60 further comprising the steps of:

providing an auxiliary sensor application controller capable of sensing the value of certain control variables;

transmitting the sensed values from the controller to the control interface in an explicit message;

identifying all application controllers using the control variables sensed by the auxiliary sensor application controller;

transmitting the sensed values from the control interface to each of the application controllers in the sensed control variable database via a network variable write using explicit addressing, whereby integration of the auxiliary sensor application controller with the other application controllers is transparent to the auxiliary sensor application controller and the other application controllers.

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A method for configuring a control system for controlling operation of automated applications, comprising the steps of:

providing a communications network;

installing a control interface on the network, the control interface including a software image database containing at least one application controller control software image;

installing an application controller on the network, the application controller configured to operate in accordance with an application controller control software image;

downloading the application controller control software image from the control interface to the application controller via the network;

installing the control software image on the application controller; and

operating the application controller in accordance with the application controller control software image.

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The method of claim 62 wherein the software image database includes a plurality of different application controller control software images; and

said downloading step being further defined as:

identifying a controller type of the application controller;

determining the application controller control software image associated with the controller type identified in said identifying step; and

downloading to the application controller the application controller control software image determined in said determining step.

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The method of claim 63 wherein the software image database is preprogrammed into the control interface.

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The method of claim 63 wherein the software image database is downloaded into the control interface after the control interface is installed on the network.

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The method of claim 65 wherein the software image database is downloaded into the control interface via at least one of a remote Internet connection, a dialed connection and a direct connection.